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Biometrical Studies of Some Races of Cyprinodont Fishes, from the Death Valley Region, with Description of *Cyprinodon diabolis*, n.sp.

By Joseph H. Wales

THE material for this study was collected by Mr. George S. Myers and the writer during the last week in March, 1930. Five apparently distinct populations of the desert minnow (*Cyprinodon*) were sampled. Three of the populations occur in Ash Meadows, Nevada, in the central part of the Amargosa Desert. Another population is found in a stream just north of Shoshone at the southern end of Amargosa Desert in California, and the fifth is in Saratoga Springs at the south end of Death Valley. These three localities, though well separated from each other, all lie in one drainage system. Concerning their isolation at the present time, Dr. Eliot Blackwelder of Stanford University says (*in litt.*), "It would not require a large climatic change to connect the various Amargosa springs in an integrated river system. There was such a river in Late Pleistocene time,—twenty thousand years ago, more or less. There may have been such a river a few centuries ago. It seems on the other hand improbable that the Amargosa and Salt Creek systems (Saratoga Springs in the latter) have been connected by habitable water since the close of the Pleistocene." All of the springs were separate at the time the present collections were made. That is certain. However two of the streams in Ash Meadows (Bradford's and King's Spring) are only two or three miles apart and it seems quite possible that they might be connected in times of very heavy rainfall. One group, which will be designated as "Bradford's," was sampled in a pool on the Bradford ranch. The temperature of the water was 72°F. This is probably quite constant as it comes from the spring but it is of course affected to some degree by the daily and seasonal fluctuations. This can also be said of King's Spring (locally known as Point of Rocks Spring), which is a small spring-fed stream quite similar to Bradford's. This is distinctly a "hot spring" with a temperature of 88 degrees. The third sample in Ash Meadows was made at Devil's Hole, which is considerably different from the rest of the springs. Apparently the pool was formed by the falling in of an underground, water-formed cave. There is no evident outlet or inlet of the water, though it is obvious that there are such, as the water is quite clear. The pool is about forty feet long, twelve feet wide and probably has a maximum depth of about thirty feet. The surface of the pool is forty feet or more below the edge of the rocky basin in which it lies. We were informed that during the last twenty years the water level has been slowly sinking. No plant life was evident. The temperature here was 93°F. The total population of the pool was probably about two hundred fish of which

sixty were secured. The stream near Shoshone is thought to be the Medbury Springs mentioned by Gilbert. The temperature of the water here was 82°F. The type of bottom, the algae, and general formation were much like those at Bradford's and King's Spring. At Saratoga Springs there are two large ponds and a small pool. This latter, from which the fish were taken, is spring-fed and has considerable algae. The temperature here was 82°F.

On the Death Valley Expedition of the United States Biological Survey (1891), specimens of *Cyprinodon* were collected at Medbury Spring, Ash Meadows, Saratoga Springs, and at Amargosa Creek in California. They were identified by Charles H. Gilbert (1893) as *C. macularius*. The Devil's Hole fish were thought to be young individuals. These, however, are described in the present paper as a new species.

The object was to make a statistical study, in order to determine whether or not there have been any morphological changes in the populations since their isolation. Because the springs were found to be so different in temperature, it was thought possible that this might be a cause of divergence among them. It will be seen that a rough correlation does exist, but due to the fact that temperature readings were taken but once it seems unwise to attempt a definite explanation on this basis. The temperature of Devil's Hole is probably quite constant, but the writer believes that the readings taken at the other points are apt to be poor indicators. If characters such as those studied in this paper are modified by the developmental rate and this in turn by temperature, and Schmidt (1919) and others have shown this to be the case, then a fluctuating water temperature will of course produce greater variability than will a stable medium.

A hasty investigation of a few stomach contents gave the following results. Bradford's Spring: apparently detritus, containing many diatoms, algae, a few small arthropods and sand. Shoshone: largely diatoms, a few crustaceans, and bivalve molluscs. Saratoga Springs: alimentary canals filled with a filamentous algae, also many diatoms and some insect remains. King's Spring: one crustacean, a few small gastropods, many diatoms and much algae. Devil's Hole: largely diatoms, a few of *Cyclops*, and one small bivalve mollusc.

In this study seven characters were selected which would lend themselves readily to statistical analysis. It is well to consider each briefly. Pectoral: the number of rays in the right pectoral fin of each fish was taken. Dorsal: all the rays were counted without regard to their simple or branched character. In many cases the last ray seemed to be a branch of the penultimate but on examination these proved to be distinct. Anal: what was said of the dorsal also applies to this fin. Ventrals: in the analysis of the data the number of rays in each of these fins were put together because of the great similarity between the two in each population. The ventrals in these fish present a very unusual and interesting situation which will be considered in some detail.

Each ventral fin articulates with a distinct pelvic bone. These bones extend anteriorly from the point of articulation with the rays, just beneath the dermis, and are covered interiorly by a thin layer of muscle and by the peritoneum. Each pelvic bone is essentially an acute triangle with a process

on the inner posterior corner which loosely articulates with that of the opposite bone. The ventral surface of each bone is made concave by a shallow, longitudinal groove. In some of the bones there is a process on the outer posterior corner resembling that on the inside; there may also be a process extending back from the point of articulation of the bone and fin. The shape of these bones varies considerably in specimens which have normal ventral fins. In the fish from King's Spring, where there is a great variation in ventral rays, the pelvic bones range from the normal shape to small rudiments and total absence. In specimens having one normal and one dwarfed ventral fin, the bones are equally different in size and form. In none of the specimens examined was there a fin present without its pelvic bone or a bone present without its fin.

Vertebrae: in an effort to study the relative variations in the first and second halves of the column, the two were treated separately. The precaudal vertebrae are those which do not have a haemal arch. The caudal vertebrae are those having a haemal arch. The hypural was not counted. Scales: this count was made along the middle of the left side, beginning anteriorly with the scale lying directly above the opercular angle, and so on back counting each consecutive scale to the last one, just past the base of the tail. In general this number corresponds to the number of transverse rows.[1]

The presence of an anal papilla in the male made sex determination easy, but as no correlation could be observed between sex and the characters studied, no separation is made in the analysis. As is seen in Table I, there is considerable variation in the relative size groups, but this fact can have little if any influence on the numerical nature of the characters.

TABLE I

SUMMARY OF DATA BY LOCALITIES

The number of individuals showing each count or measurement is indicated in parenthesis; N is number of specimens counted (number of fins in case of ventrals, which were counted on both sides of fish); Av. is arithmetic mean: *s* is standard deviation; P. E. is probable error of mean plus or minus understood; C. V. is coefficient of variation.

BRADFORD'S SPRING

Pectoral rays: 13(1), 14(13), 15(73), 16(13); N, 100: Av., 14.98; *s*, 0.55; P. E., 0.04; C. V., 3.65.

Dorsal rays: 9(1), 10(51), 11(46), 12(2); N, 100; Av., 10.49; *s*, 0.56; P. E., 0.04; C. V., 5.30.

Anal rays: 10(15), 11(80), 12(5); N, 100; Av., 10.90; *s*, 0.44; P. E., 0.03; C. V., 4.09.

Ventral rays: 3(1), 4(9), 5(63), 6(126), 7(1); N, 200; Av., 5.58; *s*, 0.61; P. E., 0.03; C. V., 10.94.

Precaudal vertebrae: 11(15), 12(110), 13(25); N, 150; Av., 12.06; *s*, 0.63; P. E., 0.04; C. V., 5.19.

Caudal vertebrae: 13(46), 14(97), 15(7); N, 150; Av., 13.74; *s*, 0.53; P. E., 0.03; C. V., 3.89.

Scales: 27(4), 28(30), 29(59), 30(7); N, 100; Av., 28.69; *s*, 0.66; P. E., 0.04; C. V., 2.30.

Total length: 20-29 mm. (121), 30-39 mm. (29); N, 150.

Sex: males (64); females (86); N, 150.

[1] It is possible that if the rays and vertebrae had been stained in the manner described by A. V. Tåning (1927) that the work would have been made easier and more accurate.

SHOSHONE

Pectoral rays: 14(1), 15(20), 16(26), 17(3); N, 50; Av., 15.62; s, 0.63; P. E., 0.09; C. V., 4.03.

Dorsal rays: 10(15), 11(33), 12(2); N, 50; Av., 10.74; s, 0.52; P. E., 0.05; C. V., 4.85.

Anal rays: 10(4), 11(43), 12(3); N, 50; Av., 10.98; s, 0.37; P. E., 0.04; C. V., 3.40.

Ventral rays: 0(15), 3(1), 5(9), 6(56), 7(19); N, 100; Av., 5.17; s, 2.18; P. E., 0.15; C. V., 42.11.

Precaudal vertebrae: 11(5), 12(42), 13(3); N. 50; Av., 11.96; s, 0.40; P. E., 0.04; C. V., 3.32.

Caudal vertebrae: 13(23), 14(27); N, 50; Av., 13.54; s, 0.50; P. E., 0.05; C. V., 3.68.

Scales: 26(3), 27(8), 28(24), 29(15); N, 50; Av., 28.02; s, 0.84; P. E., 0.08; C. V., 2.98.

Total length: 20-29 mm. (3), 30-39 mm. (18), 40-49 mm. (21), 50-59 mm. (8); N, 50.

Sex: males (23); females (27); N, 50.

SARATOGA SPRINGS

Pectoral rays: 13(1), 14(7), 15(70), 16(91), 17(31); N, 200; Av., 15.72; s, 0.78; P. E., 0.06; C. V., 4.97.

Dorsal rays: 9(2), 10(32), 11(134), 12(31), 13(1); N, 200; Av., 10.98; s, 0.61; P. E., 0.03; C. V., 5.58.

Anal rays: 10(21), 11(151), 12(28); N, 200; Av., 11.03; s, 0.49; P. E., 0.02; C. V., 4.48.

Ventral rays: 0(13), 1(2), 3(3), 4(13), 5(88), 6(261), 7(20); N. 400; Av., 5.52; s, 1.24; P. E., 0.04; C. V., 22.40.

Precaudal vertebrae: 11(10), 12(123), 13(16), 14(1); N, 150; Av., 12.05; s, 0.44; P. E., 0.02; C. V., 4.96.

Caudal vertebrae: 12(2), 13(75), 14(69), 15(4); N, 150; Av., 13.50; s, 0.57; P. E., 0.03; C. V., 4.26.

Scales: 26(1), 27(7), 28(17), 29(25); N, 50; Av., 28.32; s, 0.79; P. E., 0.07; C. V., 2.77.

Total length: 20-29 mm. (105), 30-39 mm. (59), 40-49 mm. (27), 50-59 mm. (8), 60-69 mm. (1); N, 200.

Sex: males (98); females (102); N, 200.

KING'S SPRING

Pectoral rays: 13(1), 14(9), 15(90), 16(88), 17(12); N, 200; Av., 15.50; s, 0.70; P. E., 0.03; C. V., 4.52.

Dorsal rays: 9(4), 10(72), 11(119), 12(5); N, 200; Av., 10.62; s, 0.57; P. E., 0.03; C. V., 5.36.

Anal rays: 9(4), 10(79), 11(116), 12(1); N, 200; Av., 10.57; s, 0.54; P. E., 0.02; C. V., 5.14.

Ventral rays: 0(128), 1(2), 2(4), 3(18), 4(64), 5(123), 6(61); N, 400; Av., 3.25; s, 2.37; P. E., 0.08; C. V., 72.81.

Precaudal vertebrae: 11(29), 12(165), 13(6); N, 200; Av., 11.88; s, 0.40; P. E., 0.02; C. V., 3.39.

Caudal vertebrae: 12(17), 13(147), 14(36); N, 200; Av., 13.09; s, 0.51; P. E., 0.02; C. V., 3.86.

Scales: 25(2), 26(31), 27(71), 28(44), 29(2); N, 150; Av., 27.09; s, 0.77; P. E., 0.04; C. V., 2.85.

Total length: 20-29 mm. (68), 30-39 mm. (90), 40-49 mm. (41), 50-59 mm. (1); N, 200.

Sex: males (112); females (88); N, 200.

DEVIL'S HOLE

Pectoral rays: 15(7), 16(21), 17(21), 18(1); N, 50; Av., 16.32; s, 0.73; P. E., 0.05; C. V., 4.50.

Dorsal rays: 10(1), 11(5), 12(22), 13(22); N, 50; Av., 12.30; s, 0.73; P. E., 0.07; C. V., 5.92.

Anal rays: 11(2), 12(31), 13(16), 14(1); N, 50; Av., 12.32; s, 0.58; P. E., 0.06; C. V., 4.72.

Ventral rays: 0(99), 6(1); N, 100.

Precaudal vertebrae: 10(3), 11(24), 12(22), 13(1); N, 50; Av., 11.42; s, 0.64; P. E., 0.06; C. V., 5.56.

Caudal vertebrae: 11(2), 12(17), 13(27), 14(4); N, 50; Av., 12.66; s, 0.68; P. E., 0.06; C. V., 5.38.

Scales: 24(2), 25(2), 26(23), 27(18), 28(5); N, 50; Av., 26.44; s, 0.88; P. E., 0.08; C. V., 3.31.

Total length: 10-19 mm. (15), 20-29 (35); N, 50.

Sex: males (19; females (31); N, 50.

Table I brings out the fact that most of the characters are fairly symmetrical in their distribution, with the exception of ventral rays. The coefficient of variation "C. V." given in Table I is $\frac{100\,s}{\text{Av.}}$. It will be seen from this measure that no one of the characters can well be called more constant than the rest, and it should be noted that the caudal vertebrae are not more variable than the precaudal. In respect to their variability the ventrals again present a situation full of interest. They are entirely different from the other characters. The differences in each group of comparable means will be seen in Figure 1.

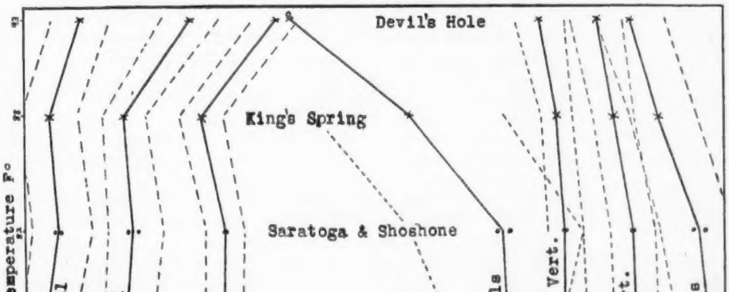

Fig.1 Trends of Character Means on Temperature.

To explain Table II let us take the first comparison, that of the Bradford and Shoshone series. For 'pectoral rays' we find 6.48, which indicates the number of times the probable error of the difference between the two means will be contained in the difference between the means. Anything over 4 is taken to indicate a "significant difference" between the two com-

pared means. Therefore 6.48 would indicate that the difference between the means in this case is not due to chance peculiarities in the samples. At the end of each comparison is indicated the number of characters in which the particular pair of samples differed significantly. We see from these figures that Devil's Hole is different from the other populations in every character. The blanks under 'Ventrals' indicate differences of over 4 but because of the almost entire absence of ventrals in Devil's Hole no statistical measure is logical. Though the differences in the populations are perfectly evident from these data, it would be unwise to stress the correlation because of the weaknesses previously alluded to. Full reliance should not be placed on the current statistical measures in this case until parallel analyses have been made and have proven the "differences" to be actual. This much can be said, that there are probably real differences in the populations as to the characters measured and that there are probably real differences in temperature at the various points. The human method of reasoning in such cases is to say that the differences are probably due to temperature. Controlled experiments are necessary, however, before this can be determined.

TABLE II

DIFFERENCE BETWEEN MEANS OF EACH CHARACTER FOR EACH PAIR OF POPULATIONS, DIVIDED BY PROBABLE ERROR OF DIFFERENCE BETWEEN THE MEANS

The difference when 4.0 or more times the probable error of the difference is regarded as statistically significant.

Bradford's Spring and Shoshone populations

Pectoral rays, 6.48; dorsal rays, 3.96; anal rays, 1.73; ventral rays, 2.86; precaudal vertebrae, 1.84; caudal vertebrae, 3.58; scales, 7.35—3 significant differences.

Bradford's Spring and Saratoga Springs populations

Pectoral rays, 11.15; dorsal rays, 10.06; anal rays, 3.46; ventrals, 1.18; precaudal vertebrae, 0.22; caudal vertebrae, 5.57; scales, 4.26—4 significant differences.

Bradford's Spring and King's Spring populations

Pectoral rays, 10.48; dorsal rays, 2.76; anal rays, 8.75; ventral rays, 27.41; precaudal vertebrae, 4.63; caudal vertebrae, 17.11; scales, 26.10—6 significant differences.

Bradford's Spring and Devil's Hole populations

Pectoral rays, 21.79; dorsal rays, 22.74; anal rays, 22.65; precaudal vertebrae, 8.89; caudal vertebrae, 15.18; scales, 24.14—7 significant differences.

Shoshone and Saratoga Springs populations

Pectoral rays, 9.62; dorsal rays, 4.17; anal rays, 1.17; ventral rays, 2.30; precaudal vertebrae, 2.00; caudal vertebrae, 0.70; scales, 2.75—2 significant differences.

Shoshone and King's Springs populations

Pectoral rays, 2.67; dorsal rays, 3.12; anal rays, 9.60; ventral rays, 11.50; precaudal vertebrae, 1.89; caudal vertebrae, 8.46; scales, 10.30—4 significant differences.

Shoshone and Devil's Hole populations

Pectoral rays, 66.04; dorsal rays, 33.61; anal rays, 20.74; precaudal vertebrae, 7.57; caudal vertebrae, 10.94; scales, 13.86—7 significant differences.

Saratoga Springs and King's Spring populations

Pectoral rays, 3.41; dorsal rays, 9.16; anal rays, 13.81; ventral rays, 30.78; precaudal vertebrae, 5.67; caudal vertebrae, 10.33; scales, 14.29—6 significant differences.

Saratoga Springs and Devil's Hole populations

Pectoral rays, 8.10; dorsal rays, 17.55; anal rays, 21.94; precaudal vertebrae, 9.66; caudal vertebrae, 11.65; scales, 16.95—7 significant differences.

King's Spring and Devil's Hole populations

Pectoral rays, 13.76; dorsal rays, 36.13; anal rays, 29.71; precaudal vertebrae, 7.26; caudal vertebrae, 6.21; scales, 7.03—7 significant differences.

The most evident point in Figure I is that there are three groups of trends in the seven characters. Without regard to King's Spring it would be supposed that there was a steady increase in number of pectoral, dorsal, and anal rays with an increase in temperature. The supposition is almost negated by the characters of the King's Spring population, in-so-far as the present data are concerned, though a more intensive analysis of the problem might straighten out the break in the curve or indeed it might make it more pronounced. In the vertebrae and scales there is a slight though regular decrease with an increase in temperature. At this point it is well to say that one fish from King's Spring had an S-shaped vertebral column, the proportionally increased length of which was due to an increase in the length of each vertebrae. In the Bradford, Saratoga, and Shoshone collections, all of the fish had normally formed vertebrae. However in the Devil's Hole series, seven fish out of the fifty had deformed vertebrae. In one fish the first vertebrae was unusually long. One fish had the sixth shortened, two had the seventh shortened, four had the twenty-second shortened, three had the twenty-third shortened, and one had the twenty-fourth and twenty-fifth shortened. These deformities probably indicate an abnormal environment, possibly high temperature.

The ventrals show a very well marked decrease with an increase in temperature. The following explanation is offered as one which might possibly be applicable to this phenomenon. The presence of at least one ventral fin in each of the populations seems to indicate that the factor or factors responsible for the production of ventral fins are present to some extent in each population and that the expression of these potentialities is controlled indirectly by the temperature at which the larvae pass their "critical period." It has been thought possible by some, e.g. Hubbs, (1926) that the rapid development of fish in warm water may cause a premature cessation of this process, with the result that the characters last to appear are modified or not developed. Some such condition might apply to the ventrals whereby the fish in the warmer waters were not given a chance to develop these fins. This explanation may as well apply to the other characters. It is hard to see, however, why a fish would have one well developed fin and one entirely absent without a distinct genetical heterogeneity.

No character in any population failed to overlap the corresponding character in the other populations, though as we saw the means were often quite different. So far as these characters are concerned therefore, we must say that all of our fish belong to one species. The taxonomist will now, if not before, assume a wary attitude. It has been admitted that no distinction can be made between any of the groups in respect to the characters which were studied statistically, but the writer nevertheless describes the Devil's Hole population as a new species, distinct from that to which the other samples belong. The Devil's Hole fish can instantly be recognized by a set of characters, which, though difficult to measure, are nevertheless present. The color, the small size and the noticeably elongated anal fin of the male are the most important distinguishing characters. The unusually well isolated character of Devil's Hole has been

spoken of already and it is quite probable that there has been no intermingling of these fish with those outside for a much longer period than the period of isolation for any of the other groups. It is the writer's belief that the differences between the populations of, for instance, Bradford's and King's Spring, are of such a nature that even if the two did mix now and then, somatic variations would be induced in each succeeding generation after their isolation so that in a comparatively few years similar characters in the two groups would be centering around quite different statistical means. The writer does not think that this would apply to Devil's Hole, for though it might be argued that the fish are dwarfed directly by certain environmental stimuli and that the color might in a similar manner be changed, this seems highly improbable. If an experiment were undertaken and it were proven that the offspring of King's Spring fish, when kept in Devil's Hole, were essentially like the fish now living there, then the population would be known to be a physiological race, not a distinct species. Even though such an experiment might be found impractical, as it is for most species, it is best for obvious reasons to recognize the differences by a name and a description until by experiment it is proven that the group is merely a variation of *C. macularius*.

Cyprinodon **diabolis**, new species

Holotype: Male from Devil's Hole, Ash Meadows, Nevada; No. 23928, Stanford University Fish Collection.

Description of holotype: standard length, 21 mm.; total length, 25 mm.; head length, 7 mm., 3 in body; greatest depth, 7 mm., 3 in body; depth of caudal peduncle, 3.5 mm., 2 in head; tip of snout to upper insertion of pectoral 7 mm., 3 in body; tip of snout to insertion of dorsal, 13 mm., 1.64 in body; tip of snout to insertion of anal, 14 mm., 1.5 in body; diameter of eye, 2 mm., 3.5 in head.

Lateral median row of scales, 27; oblique row of scales from insertion of dorsal, 9. Scales ctenoid. The nuclei of the scales are left uncovered by the preceding ones.

Row of pores along entire border of preopercle, 7 in number. A pore on posterior median border of eye. Five pores in a row from superior, posterior border of eye to snout. Another pore inside this row on interorbital space opposite posterior half of eye. Four pores in a Y formation anterior to eye.

Pectoral rays 17; greatest length of pectoral, 5 mm., 4.2 in body. Dorsal rays 12; height of fin, 4 mm., 1.43 in head; first two dorsal rays simple, the first 0.75 second which is 4 mm. long; other rays branched. Caudal rays, 28; the fin convex.

Body subovate to posterior ends of dorsal and anal bases. The caudal peduncle is almost rectangular. Top of the head flat. Mouth low, on level with ventral edge of caudal peduncle. Premaxillary entirely below middle of eye. Teeth on jaws in single series, 16 teeth in upper and 16 on lower. Width of tooth crown slightly less than one-half length of tooth, without root. The three long cusps of approximately equal length; the middle cusp but slightly wider than others. Teeth of upper approximately the

same size as those on the lower jaw. Gill-rakers 16, longest about 1/3 mm. Upper pharyngeal bone with about 5 rows of teeth. The center row with largest teeth, about 10 in number. Each tooth much compressed and in shape resembling the toe of a cat, the point of the tooth being the cat's claw. Dentigerous surface of upper pharyngeal nearly round. Surface of lower pharyngeal triangular, the posterior and inner border with a marginal row of about 18 teeth. Those teeth on the posterior border the largest, the other teeth placed irregularly.

The differences between the sexes, beside the anal papilla in the male, lie chiefly in the color, scales, and in the anal fin. The length of the anal fin in an adult male (25 mm. total length), measured from its insertion to its tip (unexpanded), is equal to the distance from posterior edge of opercle to half way between eye and tip of snout. In the female of about the same size the anal fin measurement reaches forward on the head only to the middle of the eye. The scales in the males are ctenoid, cycloid in the female. This may be true only in the breeding season, which, judging from the size of the ova, could not be much past the time the collection was made.

The following color notes were taken from newly caught live specimens. Male: Sides of a metallic bluish iridescence which changes to metallic greenish or golden in different lights. Back dark brownish. All fins edged with blackish. Dorsal with a golden iridescence. Anal whitish towards base. Opercles especially iridescent with a violet sheen on upper posterior portion. Iris iridescent blue. Female: General color more yellowish than male. Back yellowish brown. Caudal and pectoral yellowish on basal half. Dorsal edged with a black band. An indication of a lateral, dark bar through middle of caudal peduncle. Opercles metallic green. Eyes of a faint metallic blue. Young—color much like that of female but with faint vertical bars on sides. Indication of a lateral band.

In alcohol the males and females are much alike in color. Body of a plain bluish brown. Lighter on lower surface of head. Fins darker in male. Young with faint bands on caudal peduncle, much as in females and young of *C. macularius*.

This species differs from *C. macularius* in the following characters:

Cyprinodon diabolis	*Cyprinodon macularius*
Color: Adult male and female dark bluish, except on ventral surface anterior to pectorals; without bars; female without dorsal spot.	Color: Adult male more like the adults of *diabolis* but female much lighter, white not only on ventral side of head but on belly. Female always with vertical bars on sides, these occasionally on the males as well. Female with black dorsal spot. In females from some localities other than those here studied the spot may be absent.
Size: Seldom, if ever, over 26 mm., total length.	Size: Often attaining length of 40 mm., and in the Shoshone lot, more than 60 mm.

Teeth: Central cusp round, little different from outer ones.

Anal fin of male: Length equal to distance from posterior edge of opercle to between eye and tip of snout.

Teeth: Central cusp truncate, broad, much different from the small sharp outer ones. However in fish from localities other than those considered in this paper the teeth are in some specimens intermediate or like those of *diabolis*.

Anal fin of male: Length equal to distance from posterior edge of opercle to middle of eye. This is true only in fish from localities here considered. In males from Salt Creek, Death Valley, the anal fin closely resembles that of *diabolis*.

Eight paratypes in the Stanford University collection.

SUMMARY

1. There is a rough correlation between the characters studied and temperature. Pectoral, dorsal, and anal fins seem to show an increase in number of rays with an increase in temperature. Vertebrae and scales seem to decrease in number as temperature increases. This last type of correlation is true also of the ventrals but is much more evident in the latter.
2. The modification and loss of one or both ventral fins is of common occurrence.
3. The isolated populations seem to have developed considerable differences in the means of some of their characters.
4. Though the population described as a new species is not distinct from the rest in the seven characters analysed, it is by far the most unique in respect to the means. The distinctive characters of *C. diabolis* are to be found in the small size, dark color of both adults, the absence of vertical bars on the sides, the absence of a dorsal spot in the female, the long anal fin in the male, and the shape of the teeth.

LITERATURE CITED

Gilbert, C. H.
1893 Report on the fishes of the Death Valley Expedition, collected in southern California and Nevada in 1891, with descriptions of new species. *N. Am. Fauna,* No. 7:229-234, pl. 5-6.

Hubbs, Carl L.
1926 Structural consequences of modifications of the developmental rate in fishes, considered in reference to certain problems of evolution. *Am. Nat.,* 60:57-81.

Schmidt, Johs.
1919. Racial studies in fishes. II. Experimental investigations with *Lebistes reticulatus* (Peters) Regan. *Jour. Gen.,* 8:147-153.

Tåning, Å. W.
1927 Directions for staining fish with a view to racial investigation. *Jour. Cons. Internat. Explor. Mer.* 2(1):49-52.

Natural History Museum, Stanford University, California.

Jugostegalia, an Accessory Skeleton in the Gill Cover of the Eels of the Genus *Myrophis*

By A. E. Parr

IN the course of a study of the osteological features of various groups of eels, pursued by the alizarin bone-staining and glycerine-clearing method, two species of eels of the genus *Myrophis* were found to possess a peculiar system of rib-like osseous supports in the outer and ventral walls of their branchial chamber, in addition to a set of normal branchiostegal

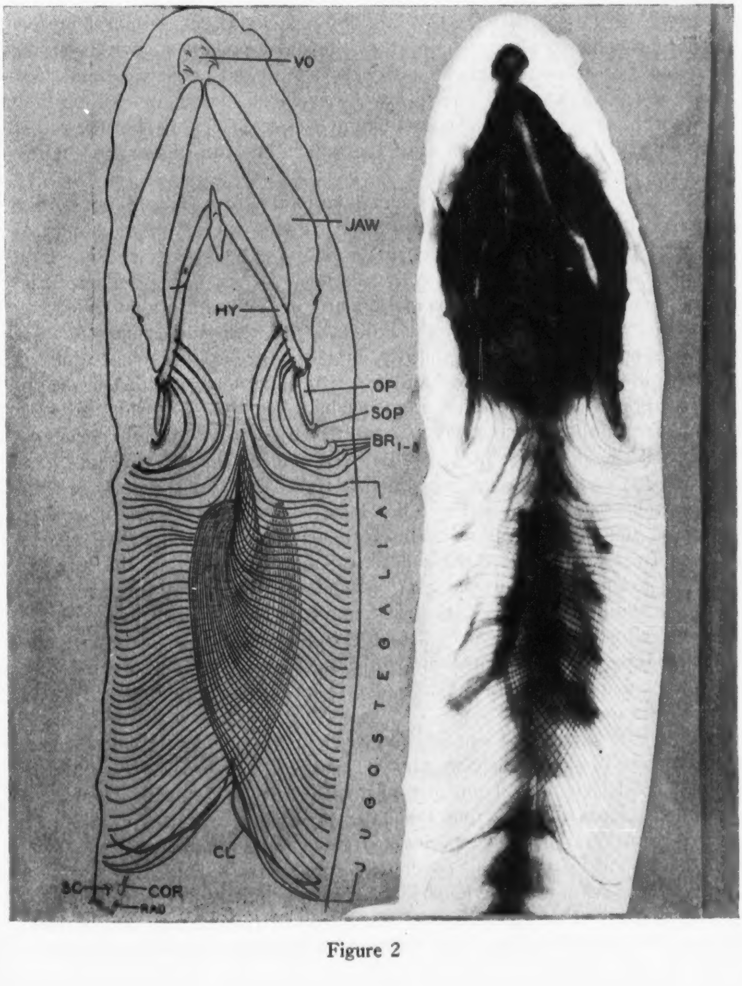

Figure 2

rays. Since, to the best of the writer's knowledge and judgment, these structures cannot be homologized with any previously known portion of the skeletal system of fishes, a separate note calling attention to their existence may be in its place, and the name of *jugostegalia* is suggested as a designation for the structures in question.

In the accompanying illustration, the right-hand figure represents a photographic reproduction of the ventral aspect of the head and branchial skeleton as it appears in a stained and cleared specimen of *Myrophis microps* Parr; the left-hand figure is an explanatory outline drawing of the same, showing the special parts with which we are here particularly concerned.

It will be noticed that the hyoid arch of each side carries five long and slender branchiostegal rays, one from the most posterior portion of the ceratohyal, or from the junction between cerato- and epi-hyals, and four from the epihyal itself. There is a well-developed opercular bone on each side. Interoperculum and suboperculum are less conspicuous, but the rather weakly ossified posterior portion of the latter bone can be seen to encircle the lower part of the operculum.

Posterior to these normal skeletal supports for the gill cover, the system of the jugostegalia can be seen, occupying the entire remainder of the outer and lower branchial chamber walls. The system consists in a considerable number (43-46 on each side in *Myrophis microps* Parr, 36 in *M. macrophthalmus* Parr) of very slender, rib-like ossifications, extending from the upper lateral part of the gill cover on each side, where they are equally spaced, with great regularity, between the last branchiostegal ray and the gill-opening, downward and forward underneath the throat, gradually converging with the other jugostegalia from the same side, crossing the median, and tapering away towards the region of the branchiostegal rays, with the posterior jugostegalia from the left lateral gill cover (in *M. microps*) ending in a half whirl on the right ventral portion; those from the right lateral cover, on the other hand, ending with straight tapered points on the left ventral side, thus producing a quite extensive ventral area of overlapping. The more anterior jugostegalia from the left gill cover do not participate in the whirl formation of the more posterior ones from the same side, but are, ventrally, more or less symmetrical with the similarly situated jugostegal rays of the right lateral gill cover, both systems crossing the mid-ventral line to a decreasing extent forwardly, so that the two most anterior jugostegalia from each side neither cross, nor meet in the median.

While the functional analogy between jugostegalia and branchiostegalia is quite obvious, the very number of the former makes it quite impossible to derive them from any normal system of branchiostegal rays, quite apart from the fact that the latter structures are also present in a normal form in the same species. Homologizing of the two types of skeletal supports for the gill cover therefore seems excluded.

In the genus *Myrophis,* as well as in many similar groups of eels, the branchial cavity extends backward far beyond the boundary of the head proper, even to the region of the eighth or ninth body segment (as counted

by the vertebrae), quite contrary to conditions among most other teleosts, in which the posterior boundary of the cavity, in the form of the pectoral arch, is usually suspended from the cranium itself. As a consequence of this development, a greater portion of the gill cover of these eels has also become so far removed from the roots of its normal skeletal supports, in the form of the opercular and branchiostegal ossifications belonging to the general system of the visceral head skeleton, above described, as to render these structures a very ineffective means of support even if they were extended backward over the entire cavity. This fact will be clearly visible from the accompanying illustrations, in which OP, SOP and BR_{1-8} represent the whole of the normal gill-cover skeleton of teleost fishes. It is, under these circumstances, of course natural to regard the system of the jugostegalia as an adventitious phylogenetic development correlated with the backward expansion of the branchial cavity, and it is quite obvious that a primary expansion of the gill cover would be necessary simply to give room for the parts here considered. Against a positively adaptivistic interpretation may be argued, however, that other eels, e. g. *Stilbiscus bahamensis* Mowbray, with similarly expanded branchial cavities and inefficient primary skeleton, are doing quite well without the development of any secondary skeletal supports for the gill cover. A more extensive investigation will perhaps increase the number of cases in which jugostegalia are found to be present, but will probably also increase the number of known exceptions.

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Breeding Behavior of the Silverfin Minnow, *Notropis whipplii spilopterus* (Cope)

By T. L. Hankinson

While making field studies of the Cyprinidae in the summer of 1928, some observations were made on the spawning activities of the northeastern race of silverfin minnow (*Notropis whipplii spilopterus*). Since so little is known of the breeding of this species, my observations appear worthy of record.

The silverfin is an abundant species of minnow in the Great Lakes region. It has a diverse habitat, but it shows a strong preference for clear, clean waters with sandy bottoms and scant vegetation, in shallows of rivers and lakes.

The literature of the species reveals little published data on its breeding. Forbes and Richardson (1909, p. 146) note that females about to spawn were taken in Illinois from May 21 to June 12. Wright and Allen (1913, p. 5) give the breeding time in the Ithaca, N. Y., region as May 21 to June 28. Evermann and Clark (1920, p. 355) say that *Notropis whipplii* spawns in Lake Maxinkuckee toward the end of July, and they report ripe fe-

males on July 18, and note 686 eggs found in the body of one female. That this fish is usually a late breeder is also indicated by the small size of the young of the year taken in collections late in the season as compared with those of other species of minnows known to spawn early.

My contribution to the knowledge of the life history of the silverfin minnow is here given. On July 24, 1928, in the Huron River at Rawsonville, Washtenaw County, Michigan, I found the species spawning. From the bank of the river, I noticed, in the shade of a small tree overhanging the water, a school of these minnows acting in a peculiar way. A dozen or more were visible. More may have been present, but the turbidity of the water made it impossible to see deeper than about a foot. They were swimming rapidly up and down, twisting their bodies and flashing their sides over the submerged portion of a log that had become partially embedded in the mud near shore, and projected toward midstream with the tip of its floating end a few inches above the surface. Near this end, in about two feet of water, the silverfins were spawning. After observing the fish, the log was removed and was found to be a crooked cottonwood limb about eight feet long and a half-foot thick, with much bark worn off and that left quite loose. Eggs of the fish were sticking to the exposed wood, but were mostly under the bark adhering in masses. Each egg measured about 1.5 mm.

With a six-foot seine, I caught a few of the breeding fish. They proved to be males; one was spent and each of the others had milt flowing from the body. These males were from 85 to 95 mm. long, and had the characteristic tubercles and pigmentation of breeding males of the species. They had numerous, small prickle-like nuptial tubercles on the upper part of the head and along the median dorsal line between head and dorsal fin.

The lower fins and the caudal were charged distally with a milky white deposit of "satin white pigment." Basally the fins of the males were of a lemon yellow. The metallic steel blue reflections, characteristic of the species, were accentuated in these breeding males. Withall they were truly beautiful fish. While no female was caught at the spawning place, one was taken in ripe condition not far away on the same river shallows. This fish was smaller than the ripe males, being 60 mm. in total length. Many small fish were found under the log, where they had gathered in all probability to feed upon eggs that failed to adhere to the log. These fish were *Hyborhynchus notatus, Notropis volucellus volucellus* and *Boleosoma nigrum nigrum.*

LITERATURE CITED

Evermann, B. W. and Clark, H. W.
1920 Lake Maxinkuckee, a physical and biological survey. Dept. Conservation Indiana, 1: 1-660.

Forbes, S. A. and Richardson, R. E.
1909 The fishes of Illinois. *Nat. Hist. Surv. Ill.,* 3:1-357.

Wright, A. H. and Allen, A. A.
1913 The fauna of Ithaca, N. Y. Fishes. Zoology field notebook, Ithaca, N. Y.: 4-6.

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Heteroconger polyzona in the Philippines

By Albert W. Herre

IN 1868 Bleeker, the most dynamic of all ichthyologists, published a description and excellent figure of one of the rarest of eels, *Heteroconger polyzona* (Versl. Med. Akad. Amsterdam, (2) 2: 332, pl.). His two specimens, obtained at Amboina, were made the type of a new genus and new family. Weber and de Beaufort redescribe Bleeker's type, and copy his figure (Fishes Indo-Austral. Arch., 3, 1916: 272).

In 1870, Dr. Günther described another species of the same genus from the Canary Islands, off the west coast of Africa.

Nothing more was known of the Heterocongridae until I discovered a new species at Dumaguete, Oriental Negros, which I made the type of a new genus (*Taenioconger chapmani*, Phil. Journ. Sci., 23, 1923: 152, pl. 3). Shortly afterward, Dr. J. Pellegrin of the Paris Museum found a second species of *Taenioconger* in a consignment of fishes from the Gulf of California.

About five years ago I received from my friend Dr. J. W. Chapman, head of the science department at Silliman Institute, Dumaguete, two badly damaged specimens of a very slender and nearly cylindrical eel, marked by about 60 cross bands, evidently a species of *Heteroconger*. I believed it to be a new species, but published nothing about it as I wished first to get material suitable for a good drawing. In 1928 I received several more specimens, one of them in perfect condition, and after prolonged study decided that these little eels from Dumaguete were really *Heteroconger polyzona* Bleeker. The differences in body proportions are hardly sufficient to warrant calling them new. The most marked difference is in the coloration, especially in the fewer bands, but I have now seen sufficient material to assure me that the variations of size, proportions, and color are much greater than given by Bleeker. His largest specimen was 275 mm. in length, while I have had specimens nearly 400 mm. long.

Heteroconger polyzona occurs in a vast colony at Dumaguete. The eels live in a strip of clear, smooth coral sand running parallel with the harbor shore and perhaps a hundred yards from the beach. This clear strip lies between the dead coral and eelgrass bordering the beach and the coral reef farther out. At low tide it is covered with never less than six feet of water; this depth is increased three or four feet at high tide.

Each eel has its individual burrow in the sand; these holes are in pairs, the two perhaps 8 inches apart. A distance three or four times greater separates each couple from its neighbors. In this manner they are arranged in a belt which extends many hundreds of yards, and perhaps several kilometers along shore. I know of no other eel which lives in colonies of this character.

When undisturbed each eel lies with the posterior third or fourth of its length within its burrow, the rest of it extended upward in a long curve like the quadrant of a circle. Every eel has its head turned against the tidal current and it is a singular sight to see hundreds of little, slender, cross-

banded eels, each in a stiff and motionless curve, all pointed in the same direction. When one wades close to them they disappear instantly, retreating far into their burrows, so that it is very difficult to obtain specimens. As a rule a spade thrust into the sand merely cuts off the head of an eel, as ordinarily they go too far down to be reached.

Unfortunately, since the presence of these eels was discovered, I have not been able to visit Dumaguete when conditions were favorable for their study and collection. However, I hope on my next visit to go there during the dry season and find out more about the habits and distribution of *Heteroconger polyzona.*

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Notes upon *Datnia plumbea*, or Ayuñgin, a Philippine theraponid

By ALBERT W. HERRE

FOR a good many years I have observed a small silvery fresh water theraponid, and have often wondered what it really was. Such specimens as I have seen in collections have been labeled *Therapon argenteus* Cuvier and Valenciennes, so I too tentatively called such specimens as came my way by the same name, until such time as I could monograph the Philippine members of the family.

My young friend, Dr. D. Villadolid, professor of zoology in the College of Agriculture, Los Baños, Luzon, Philippine Islands, has just sent me several specimens of this fish, with a request that I name it for him. His specimens came from Laguna de Bay, a great shallow sheet of fresh water near Manila. Dr. Villadolid is engaged in a biological study of the very important local fisheries of this large lake, and is just now completing his investigations of ayuñgin. Large numbers of this little food fish are caught in the lake.

DATNIA PLUMBEA Kner

Datnia plumbea Kner, Novara Exp., Zool., 1, Fische, 1865:48, plate 3, fig. 2 (erroneously fig. 1 in text); "locality uncertain, said to be Java."

Tagalog name, "Ayuñgin"

Dorsal XII-8; anal III-7; 50 to 52 scales in the lateral line to the caudal, plus 4 more on the caudal base; 9 scales above and 14 below the lateral line; 9 pyloric caeca.

The body is oblong, laterally compressed, deepest at the origin of the dorsal; the upper profile of the body is boldly convex from the dorsal to the head, then concave to the snout between the nostrils, then steeply descending the very short remaining distance; the depth is contained 2.54 to 2.7 times, the head 3.1 to 3.2 times in the length; the eye is high up, 3.55 to 3.9 times in the head; the interorbital space is equal to or slightly less than an eye diameter; the snout is a little longer than the eye, 3.1 to 3.4 times in the head; the mouth is rather small, the maxillary extends beneath the front margin of the eye. The small conical teeth are in 4 or more rows in both jaws; the outer row is slightly enlarged. The large broad preorbital is finely toothed on the nearly horizontal lower margin; the posterior margin of the preopercle

is serrated (the teeth best developed on the lower part, the inferior margin usually only slightly serrate); there are two weak spines on the opercle, the lower one much larger than the small inconspicuous upper one; the clavicle has a few small teeth, the suprascapula or post-temporal none. The dorsal and anal are decidedly heteracanthous; longest dorsal spine (fourth to sixth, but usually the fourth) 1.9 in the head, 2.3 times in the depth; the second anal spine thickest and longest, or, usually, about equal to the third, 2.1 to 2.2 times in the head; the pectoral, 1.6 to 1.8 times in the head, is shorter than the ventral, which enters 1.25 to 1.5 times in the head and falls much short of reaching the anal; the least depth of the caudal peduncle is contained 1.25 to 1.5 times in its own length; the emarginate caudal, 1.15 to 1.35 times in the head.

The color in life is uniformly silvery, darker above, paler on the under parts; the dorsal is margined by blackish, the caudal is more or less dusky, the other fins concolorous; the overlapping of the scales forms a series of faint darker longitudinal lines between the rows.

The color in alcohol varies from dull to bright silvery, usually dull leaden above, the fins much as in life; the lines between the scales are more or less evident.

Here described from 9 specimens, 69 to 109 mm. in length, from Laguna de Bay, Luzon, Philippine Islands.

This little fish is apparently confined to the Philippines, and seems to be found only in fresh water. It swarms in Laguna de Bay and other low lying lakes, and in the rivers of Luzon. I have collected it in many parts of the islands, but have never seen it in salt water. It is always small, and probably never exceeds 150 mm. in length.

It is very distinct from *Datnia* or *Therapon argentea,* with which it has been confused by all writers since Kner. As the "Novara" stopped at Manila, there is no doubt in my mind that Kner's specimens actually came from there, and not from Java, where the fish is unknown. I have kept large numbers of living specimens of all ages, from those just hatched to adults, under observation for years and at no time does this species ever have brown longitudinal bands as does the young of *D. argentea.*

Kner's excellent figure might have been drawn from one of my specimens, so closely do they agree with it.

NATURAL HISTORY MUSEUM, STANFORD UNIVERSITY, CALIFORNIA.

Further Notes on the Genus Ensatina in California

By JOSEPH R. SLEVIN

THE finding of a specimen of *Ensatina croccater* at Ft. Tejon, Kern County, California, is of considerable interest as it tends to confirm the locality of the type specimen taken by Xantus,—a locality which has always been in doubt, if not considered to be erroneous. The specimen referred to is in the collection of the California Academy of Sciences and was taken by Dr. E. C. Van Dyke under some boards near the old buildings at the Fort. It appears to be an intermediate between the Sierran form and that found in the southern mountain ranges and suggests integradation at this point.

A glance at the map of California shows the Sierra Nevadas reaching as far south as the southern border of Kern County and the Tehachapi Mountains, running about northeast and southwest, connecting the southern tip of the Sierras with the San Emidio Mountains, which in turn are

connected with the San Gabriels, thus making the Tehachapis the connecting link between the ranges of Sierran and southern forms.

The specimen found at Fort Tejon has the heavy orange-colored blotches characteristic of the southern form but lacks the occipital band so prominent in the San Diego County specimens. In the Fort Tejon specimen this is represented by two large blotches on either side of the temporal regions, which in the Sierran form are absent or reduced to very small spots. The material now available for study shows that the southern form is the most highly colored and heavily marked, and, as the more northern parts in the Sierras are reached the specimens become sparsely spotted and appear to intergrade with *Ensatina eschscholtzii,* as shown by three specimens from Tehama County in the collection of the Museum of Vertebrate Zoology of the University of California and one specimen in the collection of the California Academy of Sciences. These facts tend to lead to a classification as follows:

Ensatina croceater croceater

Ensatina croceater sierrae

Ensatina croceater eschscholtzii

Storer in his excellent review of the genus[1] did not have material from the critical areas and suggests the desirability of further search for representatives of this genus. The two specimens he refers to labeled from Fort Tejon are typical of the southern form, so it could be possible that they really came from there.

The correctness of the locality given for the specimen collected by Lockington as 75 miles S.E. of San Diego can be considered extremely doubtful, as he has under the same heading *Uta thalassina* and *Callisaurus draconoides,* both of which species are confined to the Cape Region of Lower California. No specimen of *Ensatina croceater* has been recorded from Lower California since that of Lockington's[2], but it is quite probable that in time the range of this species will be extended farther south and that it will be found in the San Pedro Martir Mountains, as is *Batrachoseps attenuatus leucopus,* a common species in San Diego County.

CALIFORNIA ACADEMY OF SCIENCES, SAN FRANCISCO, CALIFORNIA.

[1] Univ. Calif. Publ. Zool., 30 (16):443-452.

[2] Storer in his review, p. 445, evidently misunderstood the communication from Mr. Klauber, as the Laguna Mountains in San Diego County were referred to and not the Laguna Hanson Mountains in Lower California.

The *Liebespiel* of *Testudo vandenburghi*, a new name for the Mid-Albemarle Island Galapagos Tortoise.

By Ralph DeSola

EARLY April found myself and my native guide in the midst of the volcano scarred tortoise country. Once above the Santo Tomas settlement and past Villamil Mountain we began to encounter signs of the quested reptile. Old whitened shells, bleached bones, and their peculiar shaped dried dung all contributed with their old trails worn smooth over the rough black lava rock to indicate the habitat of the gigantic galapagos tortoise.

Finally some forty miles from Villamil settlement, we found ourselves at the coast on the southern border of Perry Isthmus. The hilled group of Crossman Islets bore due south-east, Duncan Island east, Cowley Mountain nearly north, while behind us we could see to the south rugged and deceptively green Villamil Mountain.

We found the black-shelled testudinatans nibbling the coarse rank grass, taking big deliberate bites from fallen cactus ears, and basking in the too sunny open lava flows, while a few slept beneath overhanging ash beds or under the dubious shade of thorn bushes.

Many were most actively engaged in mating and for a great distance (400 to 500 yards) the males could be heard shouting their deep, bass, resounding roar. We came upon such a male with his companion, being guided to the pair by his loud protracted utterances. The female is large and being broad posteriorly presents quite a matronly appearance. Her mate is more circular and readily distinguishable not only by his concave plastron, but also by the thick anterior marginal shields.

Making his advances he carefully approaches and observes her and if she shows any signs of response, i.e., as approach toward him, he will quicken his pace and commence the deeply resounding guttural tortoise shout. He collides against her heavily in a manner that appears fierce, bumping her carapace with his own for about five to eight minutes and often for longer periods. During this time he often nips at her legs but in so doing she never retracts her limbs, however brutal his attack may seem. Again he crashes against her while she views his antics all unheeding.

This constant concussion, appearing painful to the quiet observer, continues and then another hoarse bellow follows. Slowly but persistently he cleaves behind her and awkwardly mounts her from the posterior extremity. Inserting his penis (which before had been concealed and now protrudes from the cloacal vent) into her dilating cloaca, he stretches forth his long thick neck with its heavy head and straddles forward over the

hinder neural and costal shields of her carapace. Stretching and tensely holding this equilibrium so difficultly obtained, as he is now fully mounted in a semi-horizontal, somewhat slanting, spread-eagle position, the first spasmodic tupping action of their congress begins. Its preliminary jerky motion almost takes the observer unawares. Opening his strangely peculiar and diabolical face he gives vent to another yell, which sounds more shrill and piercing than the others.

The female all the while is crouched with forelegs retracted and hinder limbs stretched strongly outward, uplifting and supporting his great weight and bulk. An hour and a half has thus elapsed in a temperature of about 110 degrees F. On and on the rhythmical spasmodic action continues... slowly but not wearily he dismounts, ever clumsily and very noisily as he slides against her shell and finally hits the hard metallic resounding lava bed again. They move on in different directions seeking grass clusters.

The sun is setting and the air grows both stiller and cooler. The bird voices disappear to be taken up by the voices of mosquitoes. Camp must be made. The pack animals must be secured. Our ragged equipment and scanty provisions must be sheltered from the threatening black cumulus clouds by great empty carapaces of long dead tortoises. The cylindrically even tortoise dung with cactus imbedded longitudinally along the center and each end twisted as a waxed mustachio, must be secured for the camp fire, plus any nearby brush that is handy and will respond to the chopping of our machetes. Our many captures (now well over fifty) must be secured leg to leg with rawhide thongs and then snarled and twisted about the strong bases of spiny cactus plants. Garcia, the guide, has gone off to tether the mule "Cascabel" near some open grass land while the small weak horse "Socialista" awaits me to unload her of her heavy struggling load of Chelonians. The uncaptured animals about us are more active now than at mid-day. Many are feeding nearby while others amble about the camp apparently curious at our behavior.

The foregoing text is from my notebook kept while on the New York Zoological Society expedition of 1928 to the Galapagos Islands, under the leadership of Dr. C. H. Townsend, aboard the "Albatross II" in charge of Captain Frederick Carlson of the United States Bureau of Fisheries.

The specimens secured by myself and natives of Villamil settlement appear from measurements to be Van Denburgh's *Testudo*, species—a form that he left unnamed owing to insufficient specimen data, but classified as the Cowley Mountain Tortoise. As Cowley Mountain is the first mountain north of Villamil Mountain it is more than likely that these specimens deserve the specific name of *Testudo* **vandenburghi.**(See "The Gigantic Tortoises of the Galapagos Archipelago" by John Van Denburgh, Proc. Calif. Acad. Sci., (4) 2 (1), Sept. 30, 1914: 362-365, pl. 122 and 123).

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The Cuban Crocodile: An Account of the Species *Crocodilus rhombifer* Cuvier, with Notes on Its Life History

By C. Ralph De Sola

MENTION of the Cuban crocodile is scant and brief in general works of herpetology. Baron Cuvier, who named the species *Crocodilus rhombifer,* gives but a half page to the great reptile of the Zapata and Lanier swamps. With this condition prevailing throughout the accessible literature, it is hoped that the present article will fulfill its purpose.

The crocodile under discussion has frequently been confused with its neighbor the caiman, *Crocodilus acutus.* The Cuban crocodile inhabits only a restricted area in Cuba and the adjacent Isle of Pines, while the caiman is to be found throughout the Greater Antilles as well as on the shores of Central America and occasionally along the Gulf Coast of the United States. The following comparative table that was prepared while in the field, is aimed to clarify any further confusion:

The Cuban Crocodile ("Cocodrilo") *C. rhombifer* Cuvier	The Caiman ("Caiman") *C. acutus* Cuvier
Observed in the Laguna del Tesoro of the Cienaga de Zapata, Cuba.	Observed in Guantanamo Bay, Manzanillo, and Ensenada de Mora, Cuba. Also from specimens at Kingston, Jamaica, in the gardens of the Jamaica Institute.
1. Broad snout with very slight nasal prominence.	1. Narrow snout with large nasal prominence.
2. Bony ridge over eyes.	2. No bony ridge over eyes.
3. 6 to 8 nuchal shields.	3. 4 nuchal shields.
4. Coloring light olivaceous and with marbling at sides.	4. Deep brown coloring.
5. When standing, the body is elevated and the head is held erect.	5. Crawls on ventral surface of body rather than being supported by the legs.
6. Found in fresh water.	6. Found in salt or brackish water.

Distribution and Abundance

The habitat of *C. rhombifer* is restricted to the Cienaga de Zapata, located in the great peninsula on the south central coast of Cuba and to the Cienaga de Lanier, an immense marsh nearly intersecting the Isle of Pines, which is adjacent to the south Cuban mainland.

The range of the crocodile has been greatly narrowed in recent years owing to unrestricted hunting. The writer has been informed that the species has retreated into the most inaccessible regions of the Cienaga de Lanier on the Isle of Pines. In securing the seven specimens dealt with in this paper it was necessary to penetrate the uncharted and unexplored

Laguna del Tesoro, situated in the very heart of the great Zapata swamp. It is interesting to contrast present conditions so strongly suggestive of extinction with information recorded by Gundlach in his "Erpetologia Cubana" of 1880 (translation as in the "Herpetology of Cuba" by Barbour and Ramsden):

> Some may call my attention to the fact that there have been Caimans taken from the river Hatiguanico which drains the Cienaga de Zapata, the latter being full of Cocodrilos; to these I shall answer that this river is brackish near its mouth, where it enters Broa bay.

Cocodrilo is the local name for the true Cuban crocodile, *C. rhombifer;* while caiman refers to the common and widespread form *C. acutus*. In a more recent work entitled the "Herpetology of Cuba" and published in 1919, Barbour and Ramsden remark:

> At the present time *rhombifer* is still abundant in the Zapata swamp, although large individuals are very seldom seen.

The most accurate check obtainable on the rarity of the species are figures indicating the shipment of cured crocodile hides to Havana and Cienfuegos markets. Sr. Ignacio Bolaño, the hide curer of Jagüey Grande, revealed his records of past years, which represented a weekly killing of fifty to sixty crocodiles. In sharpest contrast with those records of former years his ledger of 1928 showed a total of only two hides per week. It is well to inform the reader that Jagüey Grande is a center of this destructive industry and therefore gives ample clue to the present low census of the species.

Size

Several works report *Crocodilus rhombifer* to be a small species not exceeding a length of seven feet. Inasmuch as this is disputed it may be helpful to record that in a Havana leather goods shop on Calle Obispo there is a twelve foot hide of the same species being permanently displayed and as facts of this matter are disputed, Barbour and Ramsden will be quoted:

> A mutilated skin, however, in 1913 in the possession of Dr. Campos at the town of Aguada de Pasajeros measured nearly twelve feet in length. Individuals far larger are still reported from the inaccessible interior of the swamp. The skull of Gundlach's great example (*a specimen sixteen and a half feet long*) which he mentions is now in the Museo Gundlach of the Havana Instituto de Segunda Enseñanza. It (*the skull*) is in a tight case and can not be measured but appears fully two feet long.

The largest specimen captured by the author's expedition for the New York Zoological Society measured six and a half feet. This was a female, taken at Placencia near the Laguna del Tesoro, April 20, 1929.

Sexual Differences

The dimorphic sexual characteristics to be presented are based upon notes made from animals skinned by my guide, whose regular occupation was that of cocodrilero (crocodile hunter).

Male	*Female*
1. Simple penis in cloacal vent.	1. Cloacal vent free.
2. Smaller individuals and of a deeper body coloration.	2. Larger individuals and of a lighter body coloration.

Food

In dissecting the intestinal tracts of the crocodiles skinned by my guide. several of the hard toothed beaks of the Cuban fresh-water gar pike, *Lepisosteus tristoechus,* were revealed as well as some of the curved claws and elongated incisor teeth of the rodent "jutia," *Capromys conga.* This alligator gar pike is locally known as "manjuari," and is very common throughout the lagoon. Specimens that were speared and brought into the boat measured from 1½ feet to a yard. It can be often seen swimming through the sluggish waters of the numerous inlets that branch off the main body of water. The rodent, jutia, is a vertebrate common to the Cienaga de Zapata.

BIBLIOGRAPHY

Barbour, Thomas, and Ramsden, Charles T.
1919 The Herpetology of Cuba. Cambridge, U. S. A.
Cuvier, Baron Von
1832 (Paris, 1807) Das Thierreich. Leipsig.
Mook, Charles C.
1921 Skull Characters of Recent Crocodilia with Notes on the Affinities of the Recent Genera. New York.
Reese, A. M.
1915 The Alligator and Its Allies. New York and London.
Torre, Carlos De La., y Aguayo, A. M.
1928 Geographia de la Isla de Cuba. Habana.
Gundlach, Juan
1880 Erpetologia Cubana. Habana.

333 Central Park West, New York City.

Notes on Stomach Contents of an Alligator

By E. B. Chamberlain

On August 9, 1929, a male alligator, *Alligator mississippiensis* (Daudin), measuring eight feet, three inches, was taken on a set line placed in a small salt-water creek at Porcher's Bluff, Charleston County, S. C. This creek passes beneath a little-traveled road by means of a wooden trunk, or culvert, and this trunk, about four feet square and ten long, served as the alligator's hole.

About sun-down, the alligator was seen at the mouth of the trunk and a set line (consisting of fifteen feet of small rope, ending with two feet of chain and a six inch hook), baited with an eight inch mullet, *Querimana curema* (Cuvier and Valenciennes), was quietly eased into place, the bait about twelve inches beneath the surface. Within five minutes the line was seen to slide down gently for eight or ten inches and investigation showed the bait was gone. A second mullet was placed on the hook and this time the line was run through the split end of a stout pine sapling, the butt of the latter pushed into the creek bank at a 45 degree angle and the bait thus hung was suspended a few inches above the water. Two hours later it was found that the hook had been cleaned again, as the tide had risen to

cover the bait. A third mullet was then tied firmly onto the hook and suspended ten inches above the water, which had now begun to drop. Early next morning the alligator was found firmly hooked, the point of the hook showing through just posterior to the angle of the jaw. The line was much worn where it had been pulled back and forth over the edge of the trunk, and the mud of the adjacent bank was torn up by the hooked animal. Thoroughly worn out, the alligator was killed and pulled ashore.

Examination of the stomach contents showed the following:

(a) Five aluminum bird bands.

(b) Eight small pine knots, worn very smooth, none longer than three inches.

(c) Six small pebbles, none over one and a quarter inches in diameter.

(d) Five marsh roots, small.

(e) About eighteen parasitic round worms, none over two inches long.

Of the preceding items the first is interesting in that it constitutes, it is believed, the first banding returns reported through such a medium, although it is well known, of course, that alligators must take a toll of certain marsh and water birds. From the action of the stomach juices the bands in question are considerably pitted. This condition, in two instances, causes difficulty in deciphering some of the figures. The Biological Survey has advised that these bands are from young little blue herons, *Florida caerulea* (Linnaeus) and Louisiana herons, *Hydranassa tricolor ruficollis* (Gosse), banded June 13, 1929, in a nesting colony located at Yough Hall Plantation, Charleston County. The pond containing this colony is about a mile and a half in a straight line from the spot where the alligator was taken. The intervening country consists mainly of cultivated fields, with some woods and swamp land, and while it is fairly certain that this particular alligator was in the habit of making overland journeys, it is thought that they were in another direction. For this reason and because all the bands represented different broods, it seems probable that the herons, on attaining sufficient growth, visited the flats and marshes at or near the spot where the alligator was killed.

The remaining items of the stomach contents, except perhaps the last, are not unusual and were to be expected. Determination of the parasitic worms has not yet been made.

In conclusion, it may be of interest to mention that the only trace of the three mullet used as bait consisted of a single opercular scale.

THE CHARLESTON MUSEUM, CHARLESTON, SOUTH CAROLINA.

The White-spotted Phase of the Racer (*Coluber constrictor flaviventris* (Say)) in Louisiana[1]

By Frank N. Blanchard

As early as 1926 Strecker and Frierson[2] referred to the racers of northwestern Louisiana as "a curious lot. Some are nearly typical *flaviventris* with sulphur colored bellies. One example is dark lustrous blue-black above, with white underparts and throat. Others have scattered light colored blotches on the upper surfaces, giving them a rather mottled appearance." But it is Mr. W. A. Bevan who has made the most definite attempt to gather information on the coloration of the racers in western Louisiana. To his personal knowledge the white-spotted phase occurs everywhere in Louisiana from Alexandria to the Sabine River and from the northern boundary of the state to the Gulf.

This phase is known locally as the ash snake and the white oak racer. The first name refers to its appearance, the second to its favored habitat. The markings may consist of white scales sparsely and irregularly interspersed among the normally colored scales (Fig. 3); or white scales may be very numerous and intermixed with variously mottled scales intermediate between these and the normal, dark, steel-blue ones. The effect is striking. The squamation of these snakes, as shown by six specimens, is identical with the figures given by Ortenburger for *Coluber constrictor flaviventris.*[3]

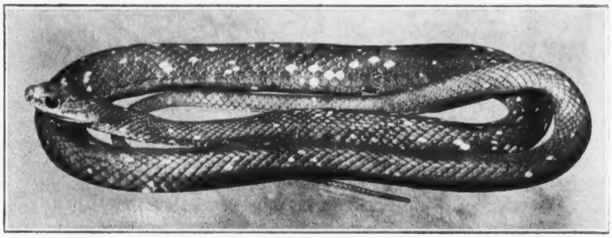

Figure 3

To determine the status of the ash snake it is necessary to know whether it occupies its range to the exclusion of the normal *flaviventris.* Strecker and Frierson say, as quoted above, that this is not the case in northwestern Louisiana. This is also stated by Bevan, in correspondence, for the region between Mansfield and De Ridder (extreme west central Louisiana). One other apparent indication of the occurrence of the un-

[1] Contribution from the Zoological Laboratory of the University of Michigan.
[2] The Herpetology of Caddo and De Soto Parishes, Louisiana. Cont. Baylor Univ. Mus., No. 5:6.
[3] The Whip Snakes and Racers. Mem. Mus. Zool. Univ. Michigan, No. 1, 1928.

spotted phase within the limits of the range outlined above is one very old specimen in the collection of the National Museum, labeled "Calcasieu Pass." Of the spotted phase, I have definite records for Converse, Pleasant Hill, south of Many, Frierson, five miles north of Frierson, Leesville, Mansfield, De Ridder and Alexandria.

In view of the facts (1) that the coloration of the ash snake is variable, (2) that there are no other features to distinguish it from *flaviventris,* and (3) that it does not occur in its range to the exclusion of the latter form, it is not deserving of a specific or subspecific name. It is, however, of much interest to know more about the extent of its range, east, north and west, and of its relationship in all ways to the typical phase.

Very few specimens are at present in collections. There is one in the American Museum of Natural History, one in the University of Michigan Museum of Zoology and there are a few in the writer's collection.

Department of Zoology, University of Michigan,
Ann Arbor, Michigan.

Herpetological Notes

ABNORMAL COLORATION OF *XENOPELTIS UNICOLOR* REINW. (1827).— The usual coloration of this species as described by De Rooij (Rept. Indo-Austral. Arch., 2, 1917: 40) is: "Brown or blackish above, iridescent, the scales light-edged; upper lip pale yellow. Lower surface white."

In about thirty specimens which I examined, the light edges of the scales form whitish or light brown lines on the back. The lines are sometimes indistinct on the middle of the back but clearly visible on the sides of the body. In all these specimens the ventrals are white.

Among the snakes of the Amsterdam Zoological Museum I found two specimens which were abnormally colored. The first specimen was collected in Java in 1880 (Oltmans, don.). It is nearly black; when in alcohol the difference in color between the edges and the center of the scales can still be seen. The chief abnormality, however, is that the ventrals are quite black. The specimen is full-grown; head and body 895 mm., tail 99 mm.

The second specimen, also collected in Java (Risselada don., 1886), is uniform yellowish white. No trace of the dark markings is to be found, head and body 825 mm.; tail 101 mm.—L. D. BRONGERSMA, *Zoologisch Museum, Amsterdam.*

AMBYSTOMA DECORTICATUM COPE REDISCOVERED IN WASHINGTON.—While studying amphibians on the Olympic Peninsula, Washington, on April 13, 1929, I was fortunate enough to find a specimen which I later identified as *Ambystoma decorticatum* Cope, an identification which has been confirmed by Professor Trevor Kincaid, of the University of Washington. Literature records seem to indicate that this is the second specimen taken of this species. The type was taken in 1885 by T. T. Streets. U. S. N., at Port Simpson, "Alaska" (really British Columbia), and was described by Cope in the Proceedings of the American Philosophical Society, XXIII, No. 124, December 1, 1886.

My specimen was taken at Forks, Washington (about 900 miles south of Fort Simpson), under a plank on the bank of a stream which emptied into a pond where I found newly laid frog and salamander eggs. The salamander may have been resting there during the day on his migration back to a moist wooded valley about a half mile away.

Ambystoma decorticatum is dark chocolate brown, closely studded with quite small whitish spots of irregular size and shape. The ventral coloration is lighter than the dorsal, but is a distinct brown. The species resembles *Ambystoma paroticum,* but may be easily distinguished by the shorter series of vomerine teeth, the less distinct (nearly invisible) parotoid gland, and the shorter and blunter head. I have taken many specimens of *A. paroticum* and had no difficulty in recognizing *A. decorticatum* as a distinct salamander. The specimen measures 216 mm. in total length, which is 24 percent. longer than the type. On reducing all of the measurements to this percent., I find that they compare favorably with those given by Cope. The biggest difference seems to be in the number of lateral folds, of which Cope writes "There are eleven well defined lateral folds and a space for a twelfth..." The Washington specimen has ten lateral folds with a little space at the axilla and groin. The relative length of the toes on the hind foot is 5-1-2-4-3 in the Washington specimen, while in the type it was 1-5-2-4-3.

I propose to publish a more complete description of the species in an "Amphibia of Washington."—JAMES R. SLATER, *College of Puget Sound, Tacoma, Washington.*

NOTE ON *AMBYSTOMA DECORTICATUM.*—In the course of accumulating data for my forthcoming monograph of the Ambystomidae, I have naturally come across a good many specimens not yet recorded in the literature. Prof. Slater's interesting note on *A. decorticatum* in the Olympic Peninsula of Washington affords an opportunity to mention other localities for this rare form, which might otherwise

await publication for some time.

I have seen eleven specimens of *decorticatum*, including the type. It is, as Slater says, very close to *gracile* (=*paroticum*).

The localities are:

Alaska: Mary I.

British Columbia: Port Simpson, Matlakatla, Prince Rupert, Chillinae Valley on Tamitly Mt., Bella Coola.

The occurrence at Bella Coola makes it probable that Patch's records (COPEIA, No. 111, 1922: 76) for *paroticum* from Bella Coola and from Hagensborg really refer to *decorticatum*.—E. R. DUNN, *Haverford College, Haverford, Pennsylvania.*

STEREOCHILUS MARGINATUM (HALLOWELL) FROM SOUTH CAROLINA.— On the morning of September 30, 1927, in company with R. N. S. Whitelaw of Charleston, the writer collected salamanders on the edge of Wassamassaw Swamp, Berkeley County, thirty miles inland from, and north-northwest of Charleston, South Carolina. A state highway crosses the swamp at this point, and since the water was low, a number of pools were readily accessible from the road.

In the course of two hours work, some sixty-odd salamanders were secured, either by dragging the shallow pools, turning logs, or digging beneath the rotting vegetation with which the swamp floor was littered. Examination showed the majority of the salamanders obtained to be *Desmognathus fuscus auriculatus* (Holbrook), of which about forty specimens were taken, *Manculus q. quadridigitatus* (Holbrook) came next with a dozen specimens, and six of *Eurycea gutto-lineata* (Holbrook) were found.

One unusual-looking salamander was noted in the lot. This specimen, sent for determination to Miss Doris Cochran, of the United States National Museum, proved to be *Stereochilus marginatum* (Hallowell). Ranging from Riceboro, Georgia, to Dismal Swamp, Virginia, this salamander has been searched for on our coastal plain for some years, but the capture cited is, so far as I know, the first to be recorded for the state. The specimen in question is a 78 mm. adult, now bearing No. 27.184.14 in the Charleston Museum collection.

The writer is indebted to Miss Cochran for determining not only the *Stereochilus*, but also a number of the other salamanders obtained at the same time.—E. B. CHAMBERLAIN, *The Charleston Museum, Charleston, South Carolina.*

Ichthyological Notes

A NOTE ON THE OCCURRENCE OF RAY'S BREAM (*BRAMA RAII BLOCH*) ON THE WEST COAST OF THE QUEEN CHARLOTTE ISLANDS, BRITISH COLUMBIA.—On August 6, 1929, L. McHugh, when tagging salmon for the Biological Board of Canada, reported that these fishes (*Brama raii* Bloch) were present in such unusually large numbers off Seal Point, on the west coast of Graham Island, Queen Charlotte Islands, British Columbia, that the fishermen were continually having difficulty in keeping them off the hooks. On the following day, they had apparently disappeared, since none were taken in that locality. This bream has not been reported previously as appearing in large numbers in this region.

Similar records of unusual abundance have been noted for this species in the waters off the Scottish coast in the autumn of 1927 (Stephen, 1928[1]), in the North Sea in October, November and December 1927 (Clarke, 1928[2]) and in Norway in November and December 1927 (Schlesch, 1928[3]).—ANDREW L. PRITCHARD, *Pacific Biological Station, Nanaimo, British Columbia.*

[1] Stephen, A. C. The Recent Immigration of Ray's Bream to Scottish Waters. Scottish Nat. 1928:28.

[2] Clarke, W. J. The Recent Invasion of Ray's Bream (Brama raii). The Naturalist, 1928: 107-109.

[3] Schlesch, H. The Recent Invasion of Brama raii Bloch. The Naturalist, 1928:186.

LAMPANYCTUS CASTANEUS GOODE AND BEAN DISTINCT FROM *LAMPANYCTUS RESPLENDENS* RICHARDSON.—The possibility that *Lampanyctus castaneus* Goode and Bean might be synonymous with *L. resplendens* Richardson has been tentatively suggested by Tåning in his "Synopsis of the Scopelids in the North Atlantic".[1] Exception to this viewpoint has already previously been taken by the writer[2] with the argument that the high number of scales (46) described and figured by Goode and Bean for *L. castaneus* as compared with the low number of vertebrae (36-37) recorded by Tåning (p. 64) for *L. resplendens* makes the taxonomic identity of the two forms seem rather improbable. The question having again been brought to the writer's attention by the presence of a small specimen of *L. resplendens* in a collection recently received for identification, a request was made to the United States National Museum to have X-ray photographs made of the type specimen of *L. castaneus.* This request has been very kindly complied with by that institution, and the photographs now at hand clearly show the presence in this specimen of 40 vertebrae, inclusive of the ultimate (composite?) caudal centrum. The number of vertebrae thus confirms the difference indicated by the scale-count recorded by Goode and Bean, and the magnitude of these differences must be considered quite sufficient to fully establish the distinctness of the two species here compared. It is unfortunate, however, that the present condition of the type-specimen of *L. castaneus*[3] does not permit of a redescription in modern terms of the arrangement of its photophores, for these have almost all become lost. Full information about the taxonomic characteristics of this species can therefore only be obtained by its recapture. The definition is of necessity provisionally limited to the combination of 3 Pol in a horizontal series, with about 40 vertebrae and about 46 scales in the lateral line, and with general appearance and proportions as described by Goode and Bean.—A. E. PARR, *Bingham Oceanographic Laboratory, Yale University, New Haven, Connecticut.*

REMARKS ON THE FLYING FISH GENUS *PTENONOTUS.*—Mr. George S. Myers of Stanford University has called our attention to resemblances between *Cypselurus monroei* Nichols and Breder, 1928, and *Exocoetus cirriger* Peters, 1877 (Bericht K. Akad. Berlin: 555, pl., fig. 1, 1a), made the type of *Ptenonotus* by Ogilby, 1908. In our opinion this is a perfectly distinct genus differing from any other flying fish and with only superficial resemblances to *Cypselurus monroei,* correlated with a comparable evolutionary level.

Recently Pietschmann has described as *Ptenonotus melanogeneion* from the Hawaiian Islands (Anz. Akad. Wien, 65, 1928:298; Bull. Bishop Mus., 73:8, pl. 2, fig. B), a flying fish which we have no question in referring to *Parexocoetus,* of which it is a barbelled form. It is allied to *Cypselurus monroei* only in so far as the same is an intermediate between typical *Cypselurus* and *Parexocoetus,* and is without relationship to *Ptenonotus.*—C. M. BREEDER, JR., AND J. T. NICHOLS, *American Museum of Natural History, New York City.*

YOUTH KILLED BY HUGE SHARK.—*"The Sun"* of Sydney, Australia, for February 16, 1930, page 1, gives a detailed account of the killing of a youth of 18 at Melbourne, on Saturday, February 15.

"Seized by a monster shark while bathing off Middle Brighton Pier at 4:30 this afternoon, Norman Clark, 18, who had just dived into the water was terribly mauled and dragged into the bay. His body has not been recovered.* * * * *."

"The tragedy is the first since 1876 and occurred in the presence of hundreds of people * * * * * The shark is supposed to be one which local fishermen have been angling for during the past week." It was a gray nurse and of a tremendous size. * * * * * Just as he (Clark) walked down the steps in the act of diving, there were cries of "shark"!

A huge fin appeared about nine feet from the edge of the pier as Clark touched the water. The next second there was a threshing of the shark's tail and the lad's arms and legs. He screamed and in a flash was dragged under.

[1] Vidensk. Medd. Dansk Naturhist. Foren., 86:49-69. Copenhagen, 1928.
[2] Bull. Bingham Oceanographic Coll. 3(3):81.
[3] Parr, Proc. U. S. Nat. Mus., 76(10):14.

Immediately afterwards the shark rose with Clark in its jaws. It appeared to have him by the waist. Clark continued to scream and to beat at the monster with his hands.

He was dragged under time and again, and each time he appeared he was being taken further out into the bay. In 30 seconds, Clark in the grip of the shark, was twenty yards from the pier, and as he emerged above the blood-stained water the shark viciously tossed him about, but never released its grip.

"About ten times he was dragged under. His screams became fainter and, leaving a red trail across the disturbed water, the shark took its victim well out into the bay." One observer estimated that the shark was between 15 and 20 feet long.

In view of the few authenticated records of sharks attacking human beings, this item from a Sydney newspaper appears worthy of record. While the identity of the shark is not known, attention may be called to the fact that in 1911, J. Douglas Ogilby[1] described a new species of shark, *Carcharias arenarius,* to which he ascribes the common name "Gray Nurse," "Sand Shark," "Shovel-nosed Shark."—LEWIS RADCLIFFE, *U. S. Bureau of Fisheries, Washington, D. C.*

A DOLLY VARDEN AS A SALMON CONSERVATIONIST.—The Dolly Varden charr (*Salvelinus parkei*) has achieved the very unenviable reputation, particularly in British Columbia, of being a most devastating predator of salmon and trout, and so great has become the chorus of disapproval that its virtual extinction is demanded.

There is herewith placed on record a circumstance, recently discovered, which may call for a pause in the general cry for annihilation and may act as a very forceful weapon in the hands of the defense—the believers in a "natural balance of nature," the opponents of "protection by extinction of enemies."

On May 8, 1930, there was caught in Cultus Lake, British Columbia, a male Dolly Varden charr (length 17½ inches, weight 4 pounds), from whose stomach were taken 8 miller's thumbs, *Cottus asper,* ranging in length from 3 to 4½ inches.

It cannot be inferred from this single record that miller's thumbs constitute a regular constituent of the diet of Dolly Varden, but on the other hand there is no reason to believe that this was an exceptional occurrence. In any event, the record would signify that, even though Dolly Varden prey upon salmon and trout, they also act as an agent for the destruction of equally voracious salmon and trout enemies and thus mitigate to a certain, yet undetermined, extent the crimes for which they are so roundly accused.—R. E. FOERSTER, *Biological Board of Canada, Vedder Crossing, British Columbia.*

[1] Descriptions of new or insufficiently described fishes from Queensland waters. Ann. Queensl. Mus., No. 10, Nov., 1911.

Reviews and Comments

A Check List of the Fishes Recorded from Australia. *By Allan R. McCulloch.* The Australian Museum, Sydney; 1929-1930.—This work has appeared in four parts of Memoir 5 of the Australian Museum at Sydney, the publication of it extending from June, 1929 to May, 1930. The "Introduction" printed in part 4 is by the Director of the Australian Museum, Dr. Charles Anderson, and sketches briefly the inception of the work. This he tells us was due to McCulloch's ideal of attempting to describe and figure each species of fish known from Australian waters. With this idea he prepared a card index from such works on Australian ichthyology as were accessible to him and a manuscript list of the genera and species of Australian fishes, including authorities and synonyms. From McCulloch's wish that this list be published under his name, should he not live to see its fulfillment, the present memoir resulted.

How accurate and painstaking the work on the list must have been may be readily revealed by examination and testing the references. Errors are rare and the well typed pages show care as well as caution has been used in their preparation. The classification is mainly that of Jordan, 1923, and largely follows that sequence. For those working on Pacific fishes, or in fact any of the faunal regions of the Indo-Pacific, this publication is of the greatest value in locating the original citations of both genera and species as now known from Australian waters. Not since Sir William Macleay's descriptive catalog of Australian fishes published long ago or in the early eighties, has a complete census of Australia's species of fishes been attempted. Truly accurate and well illustrated lists for both New South Wales and South Australia have been published and they have been based on studies of materials rather than compilation. The present work may be said to mark a new epoch in Australian fish taxonomy.

The hand of Mr. Gilbert T. Whitley, the young Zoologist of the Australian Museum to succeed McCulloch, is frequently seen in the carefully untangled specific components as well as in the extensive bibliographic revision, also in the distribution and range of each species. For many years to come this check list will ever be of great service to those wishing to consult the status and distribution of Australian fishes. To our Australian confreres we extend due acknowledgement and thanks for a good piece of work well done.—Henry W. Fowler, *Academy of Natural Sciences, Philadelphia, Pennsylvania.*

Field Book of Ponds and Streams. *By Ann Haven Morgan.* G. W. Putnam's Sons, New York and London, 1930, xvi+448 pp. $3.50.—Well written to interest and stimulate as well as to instruct; obviously designed more for the novice, student and general interested public than for the specialist, yet with a high average of accuracy in detail; bountifully illustrated by 314 pertinent line drawings and 23 fine colored and uncolored plates; emphasizing ecological relations, mentioning habits and suggesting observational and cultural methods; supplied with many keys for identifying groups; giving a balanced treatment of all the main groups of aquatic plants and of animals from protozoans to fishes, amphibians and reptiles, occurring in northeastern United States, and showing a careful selection of described and discussed types, this little book is bound to give real service. It ought to be on the shelves of every public library, college and high school in eastern North America. Some details, as the methods for collecting and preserving fish specimens, need revision in the next edition. Many omissions are explained by the advantageous system of rather thoroughly treating a relatively small number of types most likely to be met with. Some species omission, of for instance the common pike and the large-mouth bass, seem however to be unwise. But the broad realm covered by the book excuses all but the most conspicuous omissions. The nomenclature adopted, at least for the vertebrates treated, is commendably up-to-date. There are given numerous cross-references through the text, indicative of careful organization; a selected bibliography; a short glossary, and an index.—Carl L. Hubbs, *University of Michigan, Ann Arbor, Michigan.*

EDITORIAL NOTES AND NEWS

Jordan Anniversary Number

IN JANUARY, 1930, the great nestor of American ichthyology, will, fortune granting, attain his eightieth birthday. As an expression of esteem by his students and colleagues, we have decided to take advantage of this occasion to make the last number of COPEIA for 1930 the Jordan Anniversary Number. Special papers are being requested from Jordan students, of the first, second and third generations. And some financial contributions will be sought to make the project possible.

Changes in Positions

MAURICE K. BRADY will have charge of the new Reptile House of the National Zoological Park. Dr. Charles E. Burt goes to Southern Trinity College, Waxahatchie, Texas. Both these herpetologists have been with the American Museum for some time.

Willis H. Rich, who has been in charge of the Pacific salmon investigations of the Bureau of Fisheries, has joined the staff of the Zoology Department of Stanford University.

William C. Herrington, formerly of the International Fisheries Commission at Seattle, has joined the scientific staff of the Bureau of Fisheries. He is to study the remarkable haddock fishery of New England.

Dr. Harold C. Bryant, for years Director of Education and Research of the California Fish and Game Commission, and Editor of California Fish and Game, the excellent quarterly of that Commission, has accepted the new position of Assistant Director of National Parks, to take over and develop the educational and research work of the National Park service.

Research News

GEORGE S. MYERS, Stanford University, has begun a distributional study of the fish fauna of the connected Negro-Orinoco river system. He has lately been working on the fresh-water fishes of the West Indies.

Edwin P. Creaser, of the University of Michigan Museum of Zoology, has just returned from the Missouri Ozarks with a fine collection of fishes, reptiles, amphibians and invertebrates.

Prof. T. L. Hankinson has spent the summer at Stone Laboratory on Lake Erie, studying with two assistants the young stages of the fishes of that lake, for the Ohio Division of Fish and Game.

A party from the Institute for Fisheries Research, University of Michigan, has ecologically mapped and studied the fishes and fishing conditions of the lakes of Kalkaska County, Michigan. This work was subsidized by the Michigan Division of the Isaac Walton League. Another party, under John R. Greeley, studied the nursery stream problems of trout waters. One member of the party, Clarence Tarzwell, has begun an extensive investigation of the improvement of trout streams by introducing snags.

Emmet R. Dunn's paper on the American caecilians is nearly completed. One on the herpetology of Panamá, Costa Rica and Nicaragua is well along, and data are steadily accumulating for his "Natural History of the Ambystomidae."

American Fisheries Society

THE American Fisheries Society held its 1930 meeting at Toronto, on August 27 to 29, under the presidency of David L. Belding. The program comprised numerous papers on fish culture, on the food and habits of trout, on fisheries research, on the commercial fisheries and on pollution. The 1931 meeting will be held in Little Rock, Arkansas.

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